"FEEDER DEVICE FOR BARS AND RELATIVE FEEDING METHOD"

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FIELD OF THE INVENTION

The present invention concerns a feeder device for bars, able to be used advantageously in association with machines for working bars such as stirrup-making machines, bending machines, shaping machines, tying machines or other similar or comparable type of machine.

The feeder device according to the invention is suitable to pick up, in a substantially automatic manner, one or more bars at a time from a bundle of bars and to arrange said one or more bars to be fed to the operating machine.

The invention also concerns the method that uses the feeder device.

BACKGROUND OF THE INVENTION

Machines are known for working bars which work one or more bars at a time, for example to make shaped pieces for the building field or other type of product. The machines that use pre-cut bars normally have one or more feed zones wherein a bundle is discharged and/or arranged, from which the bars to be sent to the machine are picked up on each occasion.

The operation to pick up and remove the individual bars from the bundle is often very difficult since the bars, which can even reach 12 m in length and more, are all pell-mell, twisted and tangled with each other. To remove one bar from the bundle, taking it by one end, requires a great deal of effort for the worker, with risks to his safety and a slow-down in the operating cycle, which reduces the productivity of the machine.

At least partly automatic devices to feed bars to operating machines have been proposed, some of which use magnetic pick-up means. However, such devices have shown

themselves to be insufficient and unproductive, due to the difficulty of removing a bar from a bundle wherein the bar is twisted and, for a large part of its length, subject to the weight of the other bars in the bundle.

Moreover, such devices are normally equipped to remove bars having a limited range of diameters, inasmuch as their pick-up and positioning means are effective for bars with a size within a certain range, and must be replaced or in any case adapted if the bars to be worked are of a different size.

For example, these pick-up and positioning means can comprise screws or Archimedes screws that guarantee that the bars are held and transported correctly only if the bars have a diameter less than the pitch between the coils of the screws.

Another disadvantage of known machines is that they are not able to guarantee with certainty the exact number of bars picked up, which creates problems in counting and hence in the correct feed of the right number of bars to the operating machine.

Known devices also have the problem that the loaded bars may be partially misaligned and/or overlap, and that the drawing members of the operating machines to which the feeder device is associated may be incorrectly positioned.

All these shortcomings have the result that the operation to automatically feed the bars must often be interrupted due to the bars jamming and/or errors in the number of bars to be fed, with a consequent blockage of the operating machine located downstream and the need for a manual intervention to restore operations.

Purpose of the invention is to achieve a feeder device for bars, suitable to selectively pick up, in a substantially automatic manner, one or more bars at a time

from a bundle of bars and to arrange them for feeding to an operating machine which will overcome and solve the shortcomings to be found in analogous devices in the state of the art.

Another purpose is to be able to operate on bars substantially of any diameter, and to ensure that they are counted without errors caused by overlapping or by the undesired pick-up of multiple bars.

Applicant has devised, tested and embodied the present invention to overcome these shortcomings and to obtain other advantages.

SUMMARY OF THE INVENTION

The present invention is set forth and characterized in the main claims, while the dependent claims describe other innovative characteristics of the invention.

According to the invention, the device comprises first magnetic means, arranged substantially in cooperation with an end part, or near the end, of the bundle of bars from which the bar or bars are to be picked up, and second magnetic means able to cooperate with said first magnetic means in order to selectively pick up the bar or bars to be sent to the machine.

In a preferential embodiment, the first magnetic means have a relative magnetic element arranged substantially transverse to the longitudinal development of the bars, which covers with its extension substantially all the width of the bundle, or a substantial part of the width, from which the bars are taken.

To be more exact, the first magnetic means are associated with first movement means able to move them, at least in a first step of the pick-up and removal cycle, and at least for a part of their approach movement, in a direction substantially orthogonal to the plane on which the bundle

of bars lies; their function is to lift at least the end parts of a plurality of bars with respect to the bundle. To be more exact, the raised ends of the bars are arranged substantially adjacent on a single plane defined by the attractive surface of the magnetic element of the first magnetic means.

According to a variant, the first magnetic means comprise two or more distinct magnetic elements able to cooperate with the bars at relative two or more different points on their length.

The second magnetic means are associated with second movement means able to move them, at least in a second step of the pick-up and removal cycle, in a direction substantially parallel, slant-wise or curved, with respect to the plane on which the bundle of bars lies and/or with respect to the bars, temporarily co-planar, whose ends are held raised by the first magnetic means; said second magnetic means are suitable to pick up from the first magnetic means, selectively, the end part of one or more bars, advantageously one at a time, and to displace it and then release it in the desired position, in order to arrange it to be fed to the operating machine.

In a preferential embodiment, the second magnetic means cooperate with at least a drawing assembly, comprising rollers, grippers or other type, in cooperation with which the bar or bars, selectively picked up by the second magnetic means, are released and arranged so as then to be removed completely from the bundle and sent for working.

With the solution described above, even if the bars are tangled and twisted in the bundle, they can be selectively picked up and removed individually, or in the desired number of two or more, from the bundle, thanks to the cooperation between the two magnetic means and the fact

that they are picked up in two distinct phases.

To be more exact, as said above, in a first step of the pick-up cycle, the first magnetic means form a pick-up plane consisting of a plurality of adjacent bars, and the second magnetic means interact with the first magnetic means in order to selectively pick up, and in an orderly and univocal manner, with no possibility of errors, overlapping or misalignment, one or more bars at a time and unload them in the desired position, for example in a drawing element of the drawing assembly of an operating machine located downstream.

The second movement means associated with the second magnetic means, in a preferential embodiment, are able to allow a selective and controlled displacement thereof for the whole width of the first magnetic means, in order to allow the bar or bars to be selectively picked up in any position whatsoever of said first magnetic means.

According to a preferential form of embodiment, the second movement means associated with the second magnetic means comprise a linear actuator able to move the second magnetic means on a plane substantially parallel to the plane on which the bars lie and in a direction substantially orthogonal to the longitudinal development of the bars, from a first pick-up position, cooperating with the first magnetic means, to a second unloading position, cooperating with the drawing assembly, or with another element of the operating machine. In this unloading position, the second magnetic means cooperate with unloading means, for example a stop element, which cause the bar to become detached and to fall from said second magnetic means, advantageously in a position of cooperation with a drawing element of the operating machine.

The second magnetic means are therefore able to pick up,

for example one at a time, the bars whose ends are held raised by the first magnetic means, starting from the bar in the most lateral position, and then continuing until all the bars raised by the first magnetic means have been picked up.

According to a variant, said second magnetic means are moved in a curved trajectory with respect to the plane on which the bars lie, and can pick up the bars at any point of the attractive surface defined by said first magnetic means.

According to another variant, the first magnetic means are also moved, at least for part of their trajectory, in a curved or slanted direction with respect to the plane on which the bars lie, and then are lowered substantially orthogonally to said plane in the step to pick up and raise the ends of the bars.

In a preferential embodiment, the first and/or second magnetic means consist of electromagnets associated with selective feed means. According to a variant, the first and/or second magnetic means consist of permanent magnets.

In a further preferential embodiment, the first and the second magnetic means are mounted on a movable support suitable to be displaced on each occasion in correspondence with the feed zone of the operating machine where there is the bundle from which the bars to be worked are to be taken.

In another preferential embodiment, in correspondence with, or in proximity with, the position where the bars are unloaded from said second magnetic means, there are means able to be selectively activated and suitable to correct possible defects in the positioning of the bars, for example due to even only partial misalignments or overlapping, in the drawing assembly of the operating

machine. The drawing assembly can consist of rollers or, in a preferential embodiment, one or more grippers with alternating movement.

In another preferential embodiment, in cooperation with the leading ends of the bars there is a header element, able to be selectively activated at least when a plurality of bars have been picked up by said first magnetic means, are raised with respect to the bundle and are arranged substantially on a single plane.

In a further preferential embodiment, the stop element that causes the bar picked up by the second magnetic means to become detached and fall into the drawing assembly of the operating machine has an at least partly curved abutment surface in order to facilitate the detachment and to prevent the bar from rebounding.

In another preferential embodiment, at least the first magnetic means are connected to the respective movement means by means of an articulated connection that facilitates a correct and complete pick-up of the ends of the bars from the bundle, even when there are containers with a curved or shaped bottom, and even when only a few residual bars remain in the container to be picked up.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other characteristics of the present invention will become apparent from the following description of some preferential forms of embodiment, given as a non-restrictive example, with reference to the attached drawings wherein:

- figs. 1-5 show a side view of one form of embodiment of the feeder device for bars according to the present invention in one sequence of its operating cycle;
- fig. 6 shows a side view of another embodiment of the

feeder device for bars according to the invention;

- fig. 7 shows a partial front view of the device in fig. 6;
- fig. 8 shows an enlarged scale front view of a variant of a detail of the device in fig. 1;
- figs. 9 and 10 show a perspective view of a feeder device for bars according to the invention in two different steps of the cycle to pick up the bars from a bundle.

DETAILED DESCRIPTION OF SOME PREFERENTIAL FORMS OF EMBODIMENT OF THE INVENTION

With reference to the attached figures, a feeder device 10 for bars 11 according to the invention is suitable to be located upstream of an operating machine such as a stirrup-making machine, bending machine, shaping machine, tying machine or any other machine of a similar type or not.

Of said operating machine the attached figures show a drawing assembly, or drawer, 27, 127, which can consist of rollers 26a, 26b (figs. 1 and 2); 126a, 126b (figs. 6 and 7), or a gripper 226 with alternating movement (figs. 9 and 10); it is understood, however, that the drawing assembly can be of any other type.

The feeder device 10 is suitable, without requiring any modification or re-configuration, to operate on bars 11 substantially of any length and/or diameter, guaranteeing in any case to pick up the bars in an orderly and efficient manner, and to count them without mistakes.

The feeder device 10 is suitable to pick up, from a bundle of bars 12 lying at least partly in a housing seating 30, one or more bars 11 at a time to be sent to the operating machine. In this case, the housing seating 30 comprises three pockets, movable laterally, inside each of

which bars 11 of different sizes are arranged.

It comes within the field of the invention that the feeder device 10 is movable with respect to the pockets 30, or other housing seating for the bars 11, in order to move selectively according to the type or size of bars 11 to be picked up.

The possibility of moving the pockets 30 with respect to the feeder device 10, or vice versa, also allows to sequentially feed the machine with bars 11 having a different diameter, if the working program requires it, substantially without interrupting the work cycle of the machine downstream.

The feeder device 10 is mounted in this case on a supporting frame 18 and comprises first magnetic means 13 consisting of a first magnetic or electromagnetic element 14 arranged advantageously during use in proximity with one end of the bars 11 of the bundle 12.

It comes within the field of the invention that the first magnetic means 13 comprise two or more magnetic or electromagnetic elements 14, arranged at several distinct points on the length of the bars 11, advantageously near their front ends.

The first magnetic element 14 is located with a direction mainly transverse to the longitudinal development of the bars 11 lying in the respective pocket 30, and advantageously has a width such as to cover the entire width of the bundle 12. The first magnetic element 14 is associated with a first linear actuator 15, for example of the fluid-dynamic type; in the embodiment shown in figs. 1-5 the linear actuator 15 is movable vertically.

Thanks to the linear actuator 15, the magnetic element 14 can be moved along a first, substantially vertical operating direction, and correctly positioned in

correspondence with the desired bundle 12 from which the bars 11 are to be picked up.

At the start of the pick-up cycle, the magnetic element 14 is lowered towards the bundle 12, by means of the first linear actuator 15, to take the lower face thereof, comprising the attractive surface, to a position such as to exert an effect of magnetic attraction on the ends of the bars 11 located at the highest part of the bundle 12 (fig. 1). Subsequently, the magnetic element 14 is returned upwards, magnetically lifting the ends of one layer of bars 11 (fig. 3) arranged adjacent to each other so as to form substantially a plane.

According to the variant shown in fig. 8, the first magnetic element 14 is mounted on a shaped arm 31 pivoting on an oscillation pin 32. At its rear end 31a an actuator 115 is associated which allows, with a very limited excursion 33, the magnetic element 14 solid with the opposite end 31b of the shaped arm 31, to make a partly curved trajectory 34 during the step wherein the ends of the bars 11 are picked up and lifted.

According to the further variant shown in figs. 9 and 10, the first magnetic element 14 is mounted at a first end of a curved arm 31, at the other end of which an actuator 215 is associated, arranged on a substantially horizontal plane.

In both these solutions, the first magnetic element 14 is mounted on the relative arm 31 by means of an articulated joint 42, which allows it a certain freedom to oscillate, in order to facilitate the pick-up of the bars 11 even when the pockets 30 have a curved and/or shaped bottom, and also if there are only a few bars 11 remaining on the bottom of the pockets 30.

When the ends of the bars 11 have been raised by means of

the upward movement of the first magnetic means 13, second magnetic means 21 are activated, which comprise a second magnetic element 22 mounted at the end of a second linear actuator 23 mounted, in turn, on the supporting frame 18.

Here too, it comes within the field of the invention that the second magnetic means 21 comprise two or more magnetic elements 22 able to act at two or more distinct points on the length of the bars 11.

The second linear actuator 23 is able to act in a direction substantially perpendicular to the longitudinal development of the bars 11, so as to move, in this case horizontally, the second magnetic element 22 from a first advanced pick-up position (fig. 4; fig. 9), wherein it moves into cooperation with the attractive surface of the first magnetic element 14 in order to pick up one or more bars 11 from it, advantageously one bar 11 at a time, to a second retracted release position (fig. 5; fig. 10). In the second position, it releases the end of the specific bar or bars 11, which it has picked up from the first magnetic element 14, in correspondence with the drawing assembly 27, in this case consisting of two rollers 26a, 26b; 126a, 126b or of the gripper 226.

Advantageously, the second magnetic means 21 and the first magnetic means 13 are staggered with respect to each other on the length of the bars 11, so that, when the second magnetic element 22 is in its pick-up position, it does not interfere with the first magnetic element 14.

In the embodiment shown here, the sequential pick-up of the bars 11 starts with the bar located in the most lateral position facing towards the second magnetic element 22 (extreme right in figs. 1-5 and extreme left in figs. 9 and 10), and then continues picking up the bars 11 one by one towards the inside until the bars 11 held raised by the

first magnetic element 14 are all used up. When the second magnetic element 22 performs an empty travel without meeting bars 11, consent is given for a new descent of the first magnetic element 14 towards the bundle of bars 11 to pick up a new bar or bars 11.

Progressively retreating to the release position, the second magnetic element 22 moves beyond a stop element 35, which stops the picked up bar 11 by detaching it from the second magnetic element 22. This detachment causes the bar 11 to fall due to gravity, and it is channelled, for example by means of a slide 36 (figs. 1-5), into the drawing assembly 27.

According to the variant shown in figs. 9 and 10, the stop element 35 has a curved conformation, so that the detachment of the bar 11 from the second magnetic element 22, consequent to the contact with said stop element 35, occurs progressively and without risk of a rebound that could be caused by the bar 11 knocking against a surface orthogonal to its direction of displacement.

The variant shown in figs. 9 and 10 also shows a pair of rollers, respectively fixed 39a and movable 39b, cooperating with a fixed contrasting element 40 arranged substantially aligned with the fixed roller 39a.

The movable roller 39b is associated with a positioning actuator 41 and can assume a first inactive position, distanced from the fixed roller 39a (fig. 9), and a second operating position wherein it is brought near the fixed roller 39a and the contrasting element 40 (fig. 10).

To be more exact, throughout the whole step of the cycle wherein the second magnetic element 22 picks up a bar 11 from the first magnetic element 14 and makes it fall into the drawing assembly 27, the movable roller 39b remains distant from the fixed roller 39a so that a segment of the

bar 11 released by the second magnetic element 22 can be freely positioned resting on the fixed roller 39a and on the contrasting element 40, in the free space between the fixed roller 39a and the movable roller 39b.

As soon as one bar 11 has been released, the movable roller 39b is lowered and taken towards the fixed roller 39a, for example with several cycles of alternating, backwards-forwards movement. This movement of the movable roller 39b, exerting a pressure on the bar 11 contrasted by the fixed roller 39a and the contrasting element 40, allows to ensure that the end of the bar 11 is positioned correctly on the bottom of the throat of the gripper 226 (fig. 10), eliminating possible positioning errors and incorrect arrangements of the bar 11. This operation of the rollers 39a and 39b is repeated, bar by bar, also if two or more bars 11 are loaded together into the drawing assembly 27 in order to be worked simultaneously by the operating machine downstream. In this case, the operation to correct positioning or alignment defects is even more important since a partial overlapping of the two or more bars and/or an incorrect and non-homogenous grip by the gripper 226 on the two or more bars 11 can cause considerable operating problems in the operating machine downstream.

The rollers 39a and 39b can also remain closed on the bars 11, without exerting great pressure, during the cycles of alternating movement of the gripper 226, in order to prevent, during the return journey, the gripper 226 from causing the bars 11 to move in retreat.

When this positioning step is terminated, the rollers close on the bar 11 and the drawing assembly 27 is started in order to remove the bar 11 from the bundle 12 and send it towards the operating machine.

According to the variant shown in figs. 9 and 10,

downstream of the magnetic elements 14 and 22 there is a header element 37, associated with a movement actuator 38. The function of the header element 37 is to align the bars 11 with respect to each other, by acting repeatedly against the relative ends, after they have been picked up by the first magnetic element 14 and are kept raised with respect to the bundle.

The header element 37, by selectively activating the movement actuator 38, performs some abutment cycles against the ends of the bars 11 (fig. 9), making the longitudinal arrangement thereof equal in order to facilitate the subsequent step of loading the bars 11 into the drawing assembly 27 and the operations to be carried out thereafter.

In the embodiment shown in figs. 6 and 7, wherein the same reference numbers with the addition of 1 refer to the same or equivalent components of the feeder device 10 for bars 11, the feeder device 10 according to the present invention cooperates with a plane 130 on which the bundle 12 of bars is arranged. The feeder device 10 comprises first magnetic means 113 consisting of a first magnetic or electromagnetic element 114 arranged advantageously during use in proximity with one end of the bars 11 of the bundle 12.

The first magnetic element 114 is located transversely to the longitudinal development of the bars 11 lying on the supporting plane 130, and advantageously has a width such as to cover the entire width of the bundle 12. The first magnetic element 114 is associated with a movement trolley 115 movable by means of pairs of opposite wheels 116 on guides 117.

The trolley 115 and the guides 117 themselves are mounted at the upper end of a supporting frame 118, the lower end

of which is associated with a pair of wheels 119 that slide in respective guides 120. Thanks to this movable structure, the magnetic element 114 can be correctly positioned in correspondence with the desired bundle 12 from which the bars 11 are to be picked up, by moving the frame 118 along the guides 120. This also allows to use the same feeder device 10 for a plurality of machines fed from relative bundles 12 of bars 11, also located at relatively distant positions from each other.

As in the previous embodiment, the magnetic element 114 is lowered towards the bundle 12, in this case by moving the trolley 115 downwards, in order to take the lower face thereof to a position such as to exert an effect of magnetic attraction on the ends of the bars 11 located at the highest part of the bundle 12 (fig. 6). Subsequently, the magnetic element 114 is returned upwards, magnetically lifting the ends of one layer of bars 11 (fig. 7) arranged adjacent to each other in order to form a plane.

At this point the second magnetic means 121 are activated, which in this case comprise a second magnetic element 122 mounted at the end of an arm 123 rotary on a pin 24. The pin 24 is solid with a containing frame 25 also mounted on the supporting frame 118.

The rotary arm 123 allows to displace the second magnetic element 122 from the first pick-up position to the second release position, in a substantially curved direction. This allows to pick up one or more bars 11 whatever their position on the first magnetic means 114 may be.

In the release position the second magnetic element 122 positions in this case the end of the selected bar 11 between the opposite rollers 126a and 126b of a drawing assembly 27.

Thanks to the fact that it uses two distinct and

operationally autonomous magnetic means 13, 113 and 21, 121, which in a first step separate the ends of a first upper layer of bars 11 from the bundle 12, and in a second step pick up the selected bar or bars in order to locate them in a drawing assembly 27, the feeder device 10 allows an easy and rapid automatic removal of one or more bars 11, even if they are located tangled and twisted in a bundle 12.

Moreover, the compactness and limited bulk of the feeder device 10 allow it to be assembled in a movable structure which permits the selective displacement thereof, in order to serve a plurality of independent operating machines, also of different types and also located at several distinct points of the plant.

It is clear, however, that modifications and/or additions of parts may be made to the feeder device 10 as described heretofore, without departing from the field and scope of the present invention.

For example, a variant of the device may provide that, above the first magnetic element 14 there are fixed stop elements which allow to discharge, and make fall into the relative bundle 12, the bars 11 which have remained gripped on said first magnetic element 14 once the work cycle of the machine has been stopped. This discharge is obtained by lifting the first magnetic element 14 by an extra travel beyond said stop elements. The discharge of the bars 11 can also be obtained, when electromagnetic elements are used, by temporarily de-activating the electric feed to said first magnetic element 14.